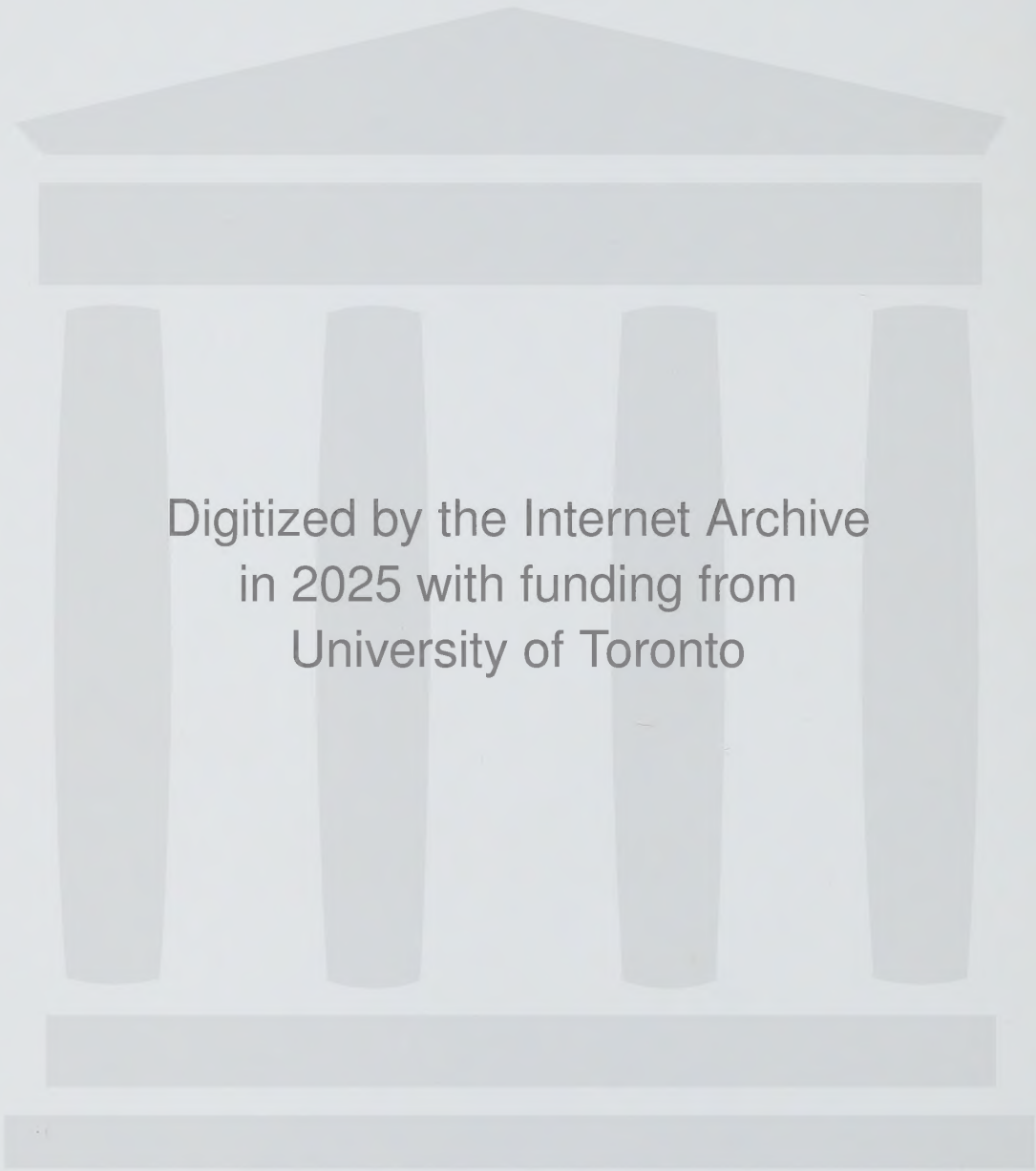
ontario educational television

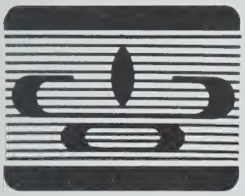
technical subjects: four-year science, technology & trades

1966–67



Four-Year Science, Technology and Trades

A SERIES OF NINE PROGRAMS
FOR TECHNICAL STUDENTS



Ontario Educational Television
Ontario Department of Education

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For program times, refer to the ETV broadcast schedule

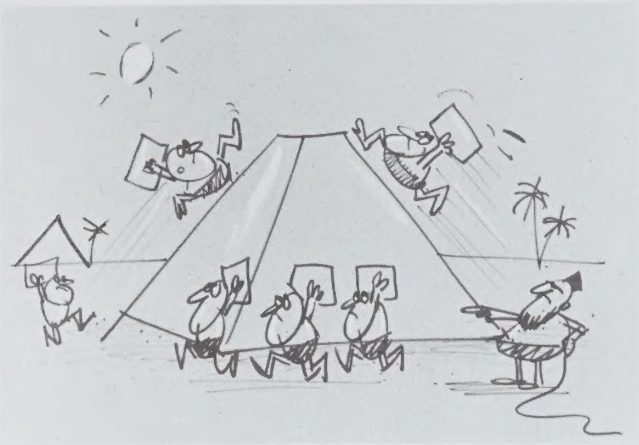
Although this is intended primarily for Grade 11 and Grade 12 students of the Science, Technology and Trades Branch, it may be viewed with profit by all technical course students of the Four-Year and Five-Year streams. The topics have been chosen for their pertinence to technical subjects in general and, as such, should be of interest to all pupils. The program titles are as follows:

1. Technology
2. Communications (Reading)
3. Communications (Writing, Speaking)
4. Measurement
5. Stress
6. Simple Machines
7. Friction
8. Graphs
9. Opportunities after Graduation

Except for the first and last programs, the entire series illustrates the vital role played by language, mathematics and science in technical endeavours. Competence in these traditional areas is recognized as essential to any sound education. In this series an attempt has been made to demonstrate their usefulness to those engaged in technology.

This booklet contains information about each film. It is hoped that teachers will inform their students of the major points in each program before the broadcast.

Program 1
Technology



This program serves as an introduction to the series. It is designed to enhance the students' appreciation of the role of technology in today's society. Technology is considered as the creative use of knowledge to do work. The subject is examined in the light of its principal elements: knowledge and skill. Knowledge is the accumulation and comprehension of fact; skill is the practical application of knowledge. The program explores the diversity of technology and its personnel requirements.

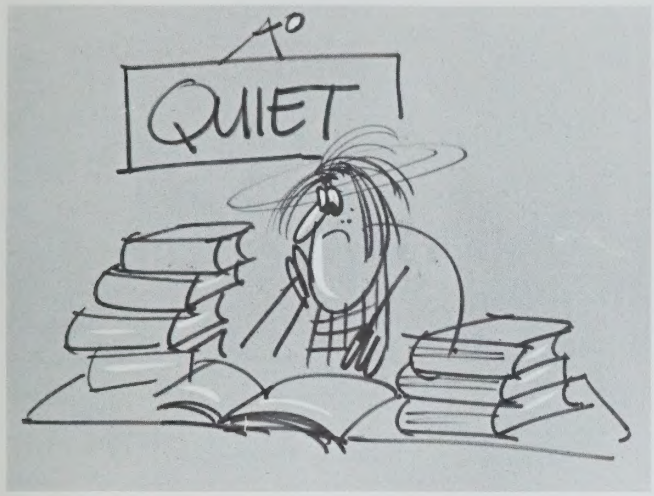
Emphasis is placed upon the fact that general knowledge and fundamental skills are best acquired through formal education, whereas specific knowledge and advanced skills may be gained 'on the job'.

POINTS OF EMPHASIS

Technology is a team effort

1. Technology is the creative use of knowledge to do work.
2. The demand for hand skills is being replaced by a demand for technical 'Know-how'.
3. Technology is a team effort.
4. Generally, jobs which require more knowledge than skill are positions of responsibility.
5. Learning is a continuing process!
6. Generally knowledge and fundamental skills should be learned at school.
7. Specific knowledge and advanced skills are acquired on the job.

Program 2
Communication (Reading)



This program demonstrates, in a practical way, how to extract factual information from written material. The library is seen as a dynamic distribution centre, rather than as a static storehouse of books. The essential difference between factual research and reading for pleasure is emphasized by example. The students are shown how to examine, scan and read technical books, magazines, reports and pamphlets in search of facts. The three principal types of library – the school library, the public library and the special library – are visited. The role of the librarian as a consultant rather than a custodian is emphasized.

POINTS OF EMPHASIS

1. The technologist reads to extract factual information.
2. To find a source of information in a library:

a) check the encyclopedia.
b) check the card catalogue for subject, author and title cards.
c) obtain the call number of the source.
d) check the shelves and extract the source.

3. To examine and scan a source step by step:

a) read the title page.
b) read the table of contents.
c) check the index.
d) read the preface.
e) read the first and last paragraphs.
f) read the headings and sub-headings.
g) read the topic sentences of paragraphs which might be useful.

4. When in doubt, ask the librarian.
5. Libraries are distribution centres, not storehouses.

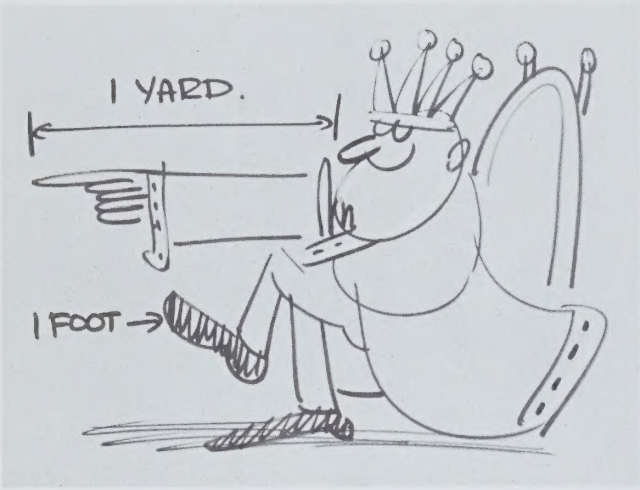
Program 3
Communication (Speaking & Writing)

Language in both oral and written form is examined in this presentation as a means of communicating technical facts. The students are shown the contrast between the efficient use of language and inept verbalizing which results from muddled and careless thinking.

POINTS TO EMPHASIS

1. Words are the chief means of communication.
2. The proper use of words is an acquired skill.
3. Don't be *ashamed* to use the correct word.
4. Say *exactly* what you mean! Avoid ambiguity.
5. Written material is meant to be read. Always consider the reader.
6. Arrange your ideas in your mind, *then* write them down.
7. Be concise; don't waste words.

Program 4
Precision Measurement

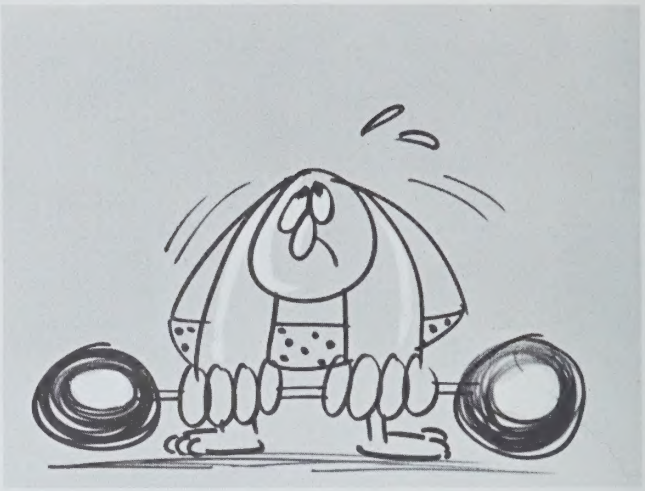


The standards of precise linear measurement are shown to be the foundation of fundamental units in mathematics. Following a brief historical sketch of the origins of measurement, Dr. K. H. Hart explains the principles of interferometry as applied by the National Research Council to the establishment of primary physical standards of length. In the Applied Physics Laboratories of N.R.C., industrial standards of length are certified. Industrial measuring tools such as micrometers and vernier calipers are calibrated from gauge blocks. The use of measuring tools is explained in detail.

POINTS OF EMPHASIS

1. Measurement is a comparison with an existing standard.
2. Standards are defined and established by parliament.
3. Primary standards are maintained by scientists.
4. Mathematical units are made real in standards.
5. Measuring instruments are calibrated against primary and secondary standards.
6. The principal measuring tools in industry are the steel rule, the micrometer caliper and the vernier caliper.
7. Tolerances are used to make allowances for the error in tools and measuring instruments.
8. Calculations are only as accurate as the least accurate measurement used.

Program 5
Stress



Practical problems may be solved by the application of mathematical expressions which are based upon scientific concepts. The simple stresses of tension, compression and shear are resolved by employing the mathematical formula $S = \frac{F}{A}$. An explanation of 'safety factor' is included.

POINTS OF EMPHASIS

1. Force is a push or pull which tends to cause a change in motion.
2. Man employs the forces of nature to do useful work.
3. Every force has a force opposing it.
4. If equal and opposite forces act on a body, a state of equilibrium exists.
5. The study of bodies at rest is called statics.
6. Internal forces that resist change are called stresses.
7. Tensile stress is the resistance to a pulling force.
8. Compressive stress is the resistance to a pushing force.
9. Shear stress is the resistance to sliding of adjacent parts of an object.
10. Stress is expressed in pounds per square inch (PSI).
11. Stress equals the force acting, divided by the area acted upon.

$$S = \frac{F}{A}$$

12. Empirical data is data obtained by experiment.
13. Safety factor is the ultimate stress divided by the allowable stress.

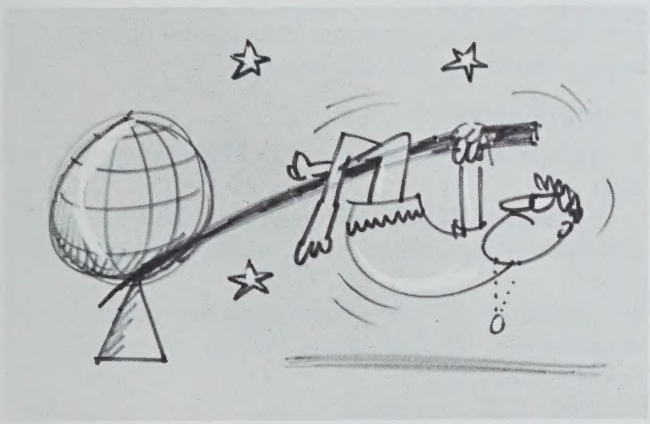
$$SF = \frac{\text{Stress (Ultimate)}}{\text{Stress (Allowable)}}$$

14. Scientific concepts expressed mathematically are used to solve industrial problems.

Program 6
Simple Machines

This program introduces the study of the mechanical advantage achieved by the use of simple machines such as the lever, the winch, the rope and pulley, the wedge, and the screw. The 'principle of moments' is demonstrated and used to solve problems involving these simple machines. The concept of work is explained.

POINTS OF EMPHASIS



1. Man is the user of tools.
2. A simple machine is a device used to change the magnitude, direction, or point of application of a force.
3. Work is done when any force moves an object through a distance in the direction of the force.

$$W = F \times d.$$

4. Just exerting a force does not involve work.

The force must cause *motion* in the direction of the force if work is to be done.

5. Time taken to accomplish the motion *does not* affect the amount of work done.
6. Mechanical advantage is the ratio of the load to the force.

$$\text{M.A.} = \frac{\text{Force}}{\text{Load}}$$

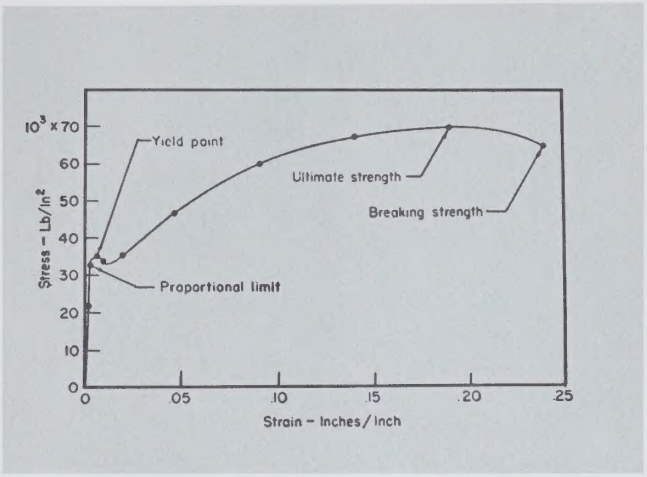
Program 7
Friction

The benefits and drawbacks of friction are demonstrated in every-day situations. The several kinds of friction are explained in some detail. The students are shown the traditional empirical methods used to find the coefficient of friction. Wear is explained as the loss or destruction of surface caused by friction.

POINTS OF EMPHASIS

1. Friction is a resistance force that opposes the relative motion of two substances or objects which are in mutual contact.
2. Friction is caused by surface roughness or by the tendency of very smooth surfaces to adhere.
3. Wear is any loss or destruction of surface resulting from objects sliding over one another.
4. Friction and wear can be eliminated if the moving surfaces are kept from touching each other.
5. Lubricants are used because they tend to keep moving surfaces apart.

Program 8
Graphs



The principle object of the program is to show the manner in which simple graphs are constructed and used. Graphic charts are a way of showing numerical facts in a form more easily understood than tabular form.

The various grid forms used in graphs are described. Emphasis is placed upon the use of graphs made from empirical data. Nomograms are shown to be an efficient method of applying mathematical formulae in a graphic way. The uses of graphic chart recorders in various forms are shown as industrial applications.

POINTS OF EMPHASIS

1. Graphs are a simple way of displaying numerical facts.
2. Graphs can be used to compare facts and to predict trends.
3. Graphs show the relationship between variables.
4. Information can be extracted easily from graphic charts.
5. Rectilinear graphs are plotted on a grid of equally spaced horizontal and vertical lines.
6. Rectilinear, semi-logarithmic and logarithmic grids are used to plot graphs by the coordinate method in relation to the x and y axes.
7. The x-coordinate is called the abscissa; the y-coordinate is called the ordinate of the plotted point.
8. Mathematical equations can be expressed graphically.
9. Nomograms can be constructed to meet the limits of equations. They can be used to solve for any values within the limits of the equation for which they were constructed.

Program 9
Opportunities after Graduation

This concluding program offers a panoramic view of the opportunities that are available to the technical course graduate in employment and in further formal education. Once again the diversity of occupations in industry, open to the budding technologist, is stressed. The apprenticeship program, with its in-service training program, is examined. The entrance requirements for advanced technological courses, vocational centres, institutes of technology and universities are presented.

POINTS OF EMPHASIS

1. Education *must not end* with High School Graduation.
2. Graduation is a beginning, not an end; it supplies a multitude of opportunities for learning in many possible fields.
3. The scope of employment opportunities is *directly dependent* on the educational level of the applicant for employment.